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ABSTRACT

Intended to suggest ways of implementing the potential of NovaNet beyond its current applications, this report begins with an overview of current educational applications of telecommunications systems. It is noted that NovaNET is not only a successful computer system for presenting instructional courseware, but that it also supports noninstructural educational applications such as management of student records and access to informational resources. Educational applications of other systems are reviewed in the areas of electronic communication and networking, collaboration, characteristics of these applications, distance learning, guided instruction in writing, and teacher support. Educational applications of NovaNET are discussed in the context of administration, access to and exchange of information, incidental learning, and instruction. Two instructional projects using the telecommunications aspects of NovaNET are described; one is a dietetics simulation at the college level, and the other is a creative writing project for high school students. The potential of NovaNET telecommunications for education is then discussed, beginning with a comparison to computer-assisted instruction. Instructional applications are then suggested in the areas of improving writing skills, developing critical thinking skills, learning and planning cooperatively, aiding distance learners, accessing information, and providing support for teachers. Some advantages and disadvantages of instruction by telecommunications are also considered, and a brief discussion of changes in the role of teachers when telecommunications-based materials are integrated into the curriculum concludes the report. (Includes 24 references.) (ALF)

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THE POTENTIAL OF NOVANET® COMMUNICATIONS FOR EDUCATION AND INSTRUCTION

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The POTENTIAL OF NOVANET COMMUNICATIONS FOR EDUCATION AND INSTRUCTION

NovaNET is an exceedingly successful computer system for presenting instructional courseware. In addition to courseware the system supports noninstructional educational applications, such as management of student records and access to informational resources. Although the telecommunications attributes of the NovaNET system have been extensively applied to education, they have even greater educational potential beyond current applications. The purpose of this report is to suggest how this potential might be tapped.

Reports of telecommunications applications on both NovaNET and other systems are indicative of the kinds of educational benefits that are possible. Therefore, this report begins with an overview of current educational applications of other systems. A summary of educational applications of NovaNET telecommunications follows. The report concludes with a discussion of the potential of NovaNET communications for building on these applications and going beyond them for both instructional and noninstructional facets of education.

EDUCATIONAL APPLICATIONS ON NON-NOVANET NETWORKS

Educational applications of computer networks cover many subject areas and goals. In science instruction, networks are serving as vehicles for students in widely scattered geographic locations to collaborate in scientific investigations. Students in English classes are being motivated to write by electronic exchanges with students elsewhere. Some networks offer inservice aid and support to teachers. In most of these applications the computer network serves as a tool to facilitate communication or data gathering and storage. These are important facets of education, but not directly instructional. The few directly instructional applications reported in the literature include distance learning in social studies and guided instruction in English, both at the post-secondary level.

Educational Applications

Communication. A number of English instructors in secondary schools report the benefits of electronic communication (Golub, 1991; J. Schwartz, 1991; Wright, 1991). Students will improved their writing and learned more about their own and other communities. Students at the college level wrote essays and transmitted them electronically for critiquing by students at another college (Marx, 1990). Students learned to write better themselves when they had to critique other students' papers.

Collaboration. Some projects use computer networks for collaboration in scientific investigations (Levin, Rogers, Waugh, & Smith, 1989; Perry, 1984). Students in diverse geographical locations collaborate by transmitting and sharing scientific data and by participating in cooperative experimentation. They interact with content experts (Perry, 1984) and also publish their work electronically (Levin, Waugh, & Kolopanis, 1988). In one instance high school students in two schools within the same community engaged in an interdisciplinary project to address social and technological problems related to the deforestation of the Amazon forest (Paddock, 1991; Siemankowski, 1991; Wolpa & Merha, 1991).

Characteristics of these applications. An important characteristic of the foregoing applications of networks is that students are required to employ strategic skills to accomplish complex cognitive tasks. The tasks include critical thinking, decision making, learning how to learn, and problem solving. All these are skills that have not previously received adequate attention in school curricula. Telecommunications is a powerful tool for implementing instruction and experience in these domains.

Objective evaluation of these programs is almost nonexistent. Teachers are enthusiastic and report that these programs are highly motivating. Most reports are largely andecdotal, although some research results are available.

In a controlled study of students' writing, Cohen and Riel (1989) found that when students communicated electronically with distant peers they wrote significantly better organized and more elaborated ideas than when they wrote for their teachers with paper and pencil. The network offers an element in writing that is not present in the classroom - writing for a real audience, such that the students are aware of what they must explain to that audience. In a different study, when students were asked to answer heuristic questions about assigned readings in English, they wrote longer and better developed responses when they did the task on the computer than with paper and pencil. Critiques of other students' work was also more extensive on the computer than with paper and pencil (Schwartz, Fitzpatrick, & Huot, 1991).

In most of the projects cited here the computer itself is not involved in instruction. It is a vehicle communicating or for transmitting information. The network offers no instructional guidance. Many of the activities are carried out offline. It is up to the teachers to plan and direct these activities. On Kidsnetwork by National Geographic and TERC, for example, the total telecommunications time alloted each subscriber school is a mere 120 minutes to accommodate 30 students.

Directly Instructional Applications

Distance learning. Distance courses have been available for some time, first by correspondence and later primarily via television. These media lacked two major ingredients that promote learning - interaction and feedback - ingredients that telecommunications can successfully incorporate. Coombs (1991) used computer conferencing to replace classroom discussion in a postsecondary distance course in social studies. Mason (1992) describes the benefits of computer conferencing in a distance learning MBA course for middle and senior managers. He notes that computer conferencing and discussion encourages critical thinking because the discussion is written and participants have an opportunity to reflect on comments and to analyze them. Given the opportunity to get critical feedback from others, they are able to reformulate their ideas. Experts in the field can comment. Working people can participate because they don't have to leave their

offices to do so.

Guided instruction in writing. One networked program first guides students in a critical thinking task such as analyzing an essay, and then provides the option of posting the responses on a bulletin board. The instructor and other students are then free to enter comments and critiques (H. J. Schwartz, 1988). Students learn a critical thinking process by working through the program. In addition, they learn from the work of others and from critiques of their own work.

Teacher Support

The benefits of telecommunications are not limited to students. Some networks include aid to inservice teachers (Perry, 1984; Wolpert & Lowney, 1991; Wright, 1991). This takes various forms from planning conferences to providing expert advice.

EDUCATIONAL APPLICATIONS OF NOVANET TELECOMMUNICATIONS

Administration

A major application of the communications features of the NovaNET system is storing students' grades. The system is very secure and is particularly useful for record keeping in service courses such as beginning physics and chemistry which enroll hundreds of students. Students' work online and offline are entered into this online gradebook at a tremendous savings of labor.

Access

Both access to information and sharing of information are essential to learning and scholarship. The NovaNET system facilitates exchange of information. The University of Illinois Library Online Catalog can be accessed from any NovaNET site. ERIC Digests Online, which presents summaries of recent articles in ERIC, is available on NovaNET. Users also have access to the national network, Internet and to other networks linked to Internet. This enables them to communicate with individuals at other educational institutions. Scholars can confer or transfer manuscripts electronically rather than in person or by mail. Discussions about research problems need not be delayed until researchers can to meet.

Incidental Learning

NovaNET supports notesfiles for discussions of a broad spectrum of topics. Some files, such as "education," serve as a forum for discussions. Others, such as "micronotes," provide a resource for assistance with problems or for obtaining information. For example, users might ask if anyone has had experience with a particular piece of software. Some notesfiles are essentially recreational and are as diverse as "recipes" and "poets." These files are not intended to present instruction, and thus do not have instructional goals.

Instruction

The preceding applications of NovaNET telecommunications are merely related to instruction. Access to information and mechanisms

for keeping records are indeed essential to effective educational systems; however, they are support systems. They are not directly instructional. A search for instructional applications of the telecommunications aspects of NovaNET revealed only two projects, one at the college level and the other for high school students.

Dietetics simulation. A decison making program was developed for dietetics students, using student personal notes (i.e., e-mail) to simulate a clinical case (Aljadir & Stevens, 1987). A case was presented in the base note, describing a college student who was experiencing weight problems. Each dietetics student was asked to respond to the situation, after which the instructor adjusted the case scenario for each individual student. The program went through three such iterations. In the first scenario, for example, the student was asked "to request further information and estimate daily calorie intake to accomplish a safe loss pattern" (p. 119). The instructor then updated the scenario and the student responded again.

Students predicted different weight-loss patterns. At the final class discussion copies of the students' responses were distributed. Not only did the students gain a quasi-clinical experience, but they had the opportunity to compare their work to the decisions and results of others.

Creative writing. A creative writing project just underway in the 1991-92 school year is another example of using NovaNET telecommunications for instruction. The program involves high school students in an English class in Chicago and another in Rantoul. The teachers generate topics in group notesfiles and the students respond. The initial topic, for example, was to "Introduce yourselves." Even more interesting was the development of cooperative "jazz chants." A student in one school asks questions in a jazz-like rhythm, leaving room for a response after each. A student in the other school fills in responses, hopefully in the same rhythm.

POTENTIAL OF NOVANET TELECOMMUNICATIONS FOR EDUCATION

Comparison to CAI

The task in most computer-based instruction on NovaNET is to acquire knowledge. For the most part the lessons are tutorials or drills. Students respond to questions for which the answers are either right or wrong. Knowledge acquisition is obviously essential to education, but clearly not sufficient. It is also important to learn how to solve problems for which there are no preset solution rules and for which there may be no "right" answer. These tasks require the kinds of critical thinking skills one applies, for example, in essay analysis, medical diagnosis, or decision making in a business environment. There may be several paths to solution, none of which is wrong. Rather, some paths may be more efficient or may generate better results than others.

Critical thinking tasks are usually presented as simulations in CAI. A major difference between CAI and telecommunications instruction is that the former is individualized and the latter group-based. In CAI simulations students learn by practicing skills and getting feedback about their performance. Feedback is either self-evident (e.g., the patient survived) or preprogrammed in the computer (e.g., laboratory test X provided no new information). The learning experience may be dramatic and relatively realistic.

Learning in a telecommunications task provides different insights than learning in individualized simulations. In telecommunications learning is a consequence not only of individual problem solving but also of interaction with other people (in real time or otherwise). Students learn by observing how other people solve problems. They also learn from discussions and critiques of one another's decisions and from gathering and presenting evidence to support an opinion that differs from someone else's.

CAI simulations often require extensive and complex programming; hence they are time consuming to produce. Further, given the potential for many paths to solutions, it is difficult to anticipate all possible paths and thus to prepare and preprogram adequate informative feedback.

The application of NovaNET telecommunications to critical thinking tasks avoids these disadvantages of simulations. No programming is necessary. Perhaps more important, feedback can be provided by instructors and other students at the time the problem is being solved. There is no need to anticipate students' procedures. Participants can simply ask for an explanation if they do not understand a person's thinking. An additional feature of telecommunications is that students can take time off to research information. In a patient management task, for instance, they may need to gather more information about a particular disease or a drug. They can do so and then return to the discussion.

Suggestions For Instructional Applications

Improve writing skills. As noted earlier, telecommunications can be employed to guide students in the processes of writing by telling them not only what to do but how to do it. A major advantage of this type of program is that the student is learning by doing. However, the student is not left to flounder. Learning can be guided. On NovaNET an instructor can guide the writing process by inserting base notes - hints or questions - which a student should consider.

There is also the option of allowing both the instructor and other students to critique the work. Students can gain insights into how

well their writing communicates with others. By critiquing other students' work they gain an understanding of the reader's perspective.

NovaNET can be employed as a vehicle for students in different communities to write about many different topics. They can get acquainted with one another, learn about one another's schools and communities, and discuss topics of common concern.

Telecommunication has proved to be very effective. Experience and research have demonstrated that when students write on the computer they are motivated to write more than when writing with paper and pencil. Moreover, when writing to real people students are motivated to develop their ideas more fully.

Develop critical thinking skills. NovaNET notesfiles can be employed in two ways to help students engage in higher order thinking skills. First, the communications and notesfile systems can serve as a forum for guided group discussions in problem solving. Instructors and other experts can be involved in the discussions. Experienced practitioners, for instance, can introduce new angles. Students can reformulate their ideas based on feedback from others (Mason, 1992).

Second, lessons can be written that lead students through effective procedures for accomplishing the goal while at the same time leaving feedback and judging to either computer or human intervention at the end of the lesson. More than that, the lesson can be programmed to provide hints about how to go about implementing those ideas, as in the writing lessons described earlier.

Learn and plan cooperatively. There are any number of occasions in which students and/or instructors need to meet in person to plan activities, but getting together physically is difficult if not impossible. Sometimes a course requires students to participate in cooperative projects but often their schedules make it difficult. A considerable amount of planning can be done through telecommunications. Conferences across different institutions can also be expedited by preliminary planning. An additional benefit is the savings of time and money to travel.

Small group conferences about applied cases (student teachers, veterinary medicine, or medical students) can broaden the experiences of students, yet allow them to be in different geographical locations.

Students in different locations can learn about one another's cultures. Pooling data and resources, they can engage in activities such as publishing newspapers or implementing cooperative experiments.

Aid distance learners. Off-campus students lack the personal contact with instructors and other students that is so important an element in learning. Telecommunications facilities provide some of this contact and contribute significantly to the value of correspondence courses.

In some instances, students must be off campus to serve an internship. They may be in different communities. For example, some student teachers practice-teach in Chicago suburbs. They cannot attend classes in person to discuss their experiences, but they can keep in touch with peers and instructors via a NovaNET notesfile. This interaction can add immeasurably to the value of student teaching.

Access to information. Using NovaNET, students have access to numerous databases as well as to the University of Illinois library. This enables them to conduct research far beyond what was previously possible.

Support for teachers. Teachers often learn about new curricula or

new methods of instruction by participating in workshops. They need continuing support when implementing these materials or concepts in the classroom, but often support is not available. NovaNET can provide online support through its telecommunications network. Ongoing support is critical to the successful implementation of new directions in education, at least for the first year of implementation. A program that might otherwise be lost can be saved.

- All teachers benefit from exchanging information about matters such as successful pedagogical techniques and the value of specific computer-based materials. They can also plan conferences without having to travel and meet in person (Kimmel, Kerr, & O'Shea, 1987; Moskaluk, Moore, & Moore, 1984/85). In many instances teachers in small rural communities are expected to teach subjects for which they are not prepared. Ongoing support via telecommunication with experts at universities and with teachers experienced in the subject helps them with lesson preparation and also relieves them from a feeling of isolation. University faculty benefit by keeping in touch with current activities in school classrooms.

Advantages Of Instruction By Telecommunication

Psychological/social. Salomon (1991) cites evidence that the "best" learning is constructive and intentional. Intentional learning is defined as learning more than just enough to perform on a test. Learning is most likely to occur when students take an active role and when they intend to do more than learn in order to perform. It has also been reported that learning is facilitated when students learn in small groups. All of these conditions are present in the networks projects described earlier.

Some students are hesitant to speak up in class. They may feel that they have low standing among their peers and that their ideas will not be taken seriously. In some instances one or two individuals seem to dominate a conversation, and in effect keep others from participating fully. In telecommunications, all students can participate equally. Age and race bias are not present. On the NovaNET system, comments can even be anonymous, so concern about status or insecurity about one's knowledge need not be a problem. In addition, participants in electronic communication seem to be less inhibited than in face-to-face conversation (Willis, 1991).

Educational. There is some evidence that groups that meet electronically are more focused than those who meet face-to-face, although they take longer to reach a consensus (Willis, 1991). It may be that they exchange fewer remarks because it takes longer to type than to speak.

Asynchronous communication enables participants to think about comments or to do some research before entering responses.

Students need to learn how to learn and how to gain access to knowledge (Forsythe & Collins, 1986). NovaNET provides a facility for learning these skills.

No programming is needed in order to use the NovaNET communications features. All of an instructor's time can be invested in developing the design of a learning situation. He or she does not have to learn a programming language or seek and hire a programmer and then try to explain the project.

Disadvantages

Typing skill. Written communication on NovaNET requires typing.

This may be a problem for some individuals, particularly those who have not grown up in the computer age and have had no reason previously to develop keyboarding skills. However, computers have become so pervasive that this is not likely to be a problem for long. Some physically handicapped individuals may find typing too burdensome for communication. This problem may also be ameliorated by advances in technology.

Time to communicate. Clearly, the time required to type a message is greater than the time to deliver it orally. However, the shorter length of time to communicate orally is not always an advantage. If a discussion is very intensive and complex, it may be difficult for listeners to recall all of the information transmitted orally. However, if information is written, participants can review it.

Written vs oral communication. Written communication lacks some of the information transmitted in aural and visual communication, when individuals are physically together or when they converse by phone (Kiesler, Siegel, & McGuire, 1984). Body movements such as a raised eyebrow or a shrug of the shoulder conveys meaning in addition to that presented by written words. Similarly, the information conveyed by intonation in speech, such as emphasis on a word or phrase, or a message delivered in a questioning tone of voice adds meaning to verbal communication. These aural and visual cues are not present when communication is written, as on networks. It is not known whether or how these differences affect communication on computer networks.

Limited screen capacity. Display screens have limited capacity. Text must be either scrolled or presented on successive displays. When an extensive amount of text is presented it is more difficult to skim the content when compared to print materials.

DISCUSSION

We need to reorient our thinking about the instructional potential of the NovaNET system to include the application of its telecommunications features to instruction. As noted earlier, new and enriching types of activities become possible.

Curriculum and management styles are affected when telecommunications-based materials are introduced. Instructors will have to change their systems of managing and evaluating students' work. In order for these programs to succeed they must be integrated into the curriculum. They are least likely to be effective learning experiences if they are treated as "extras," and not as part of the basic curriculum. Integration requires changes in perceptions of goals that the curriculum can attain, changes in the responsibilities of instructors, and changes in classroom management. Instructors may resist these kinds of changes. Training and ongoing support for instructors is essential.

It is important to consider all factors that affect the efficacy of using telecommunications - not only the instructional goals, but the students, the tasks, the availability of equipment, and the environment in which the studies will be carried out (Steinberg, 1991).

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